I R T Electronics Pty Ltd A.B.N. 35 000 832 575
26 Hotham Parade, ARTARMON N.S.W. 2064 AUSTRALIA
National: Phone: (02) 9439 3744 Fax: (02) 9439 7439
International: +61 2 9439 3744 +61 2 9439 7439
Email: sales@irtelectronics.com

IRT Eurocard

Type DDA-3100

34 Mbits/s Data Distribution Amplifier

Telstra Serial Item Numbers

347/93 DDA-3100

347/94 Operations Manual - DDA-3100

Designed and manufactured in Australia

IRT Eurocard

Type DDA-3100

34 Mbits/s Data Distribution Amplifier

Instruction Book

Table of Contents

This instruction book applies to units later than S/N 9500000.

IRT Eurocard type DDA-3100
34 Mbits/s Data Distribution Amplifier

GENERAL DESCRIPTION

The DDA-3100 is a data distribution amplifier whose inputs and outputs comply with ITU Rec G703 (34 Mbit rate). When connected to another DDA-3100 via “handshake cables” automatic protection switching can be effected.

The front panel of the DDA-3100 provides a break access facility for the incoming signal in the form of a 1.6/5.6 U-link.

Three outputs are provided at the rear of the module with an additional output for monitoring purposes on the front panel. The primary output is controlled by relays to provide a bypass signal from the input in the event of a power failure.

Indicators are provided on the front panel for: Data loss
AIS detect (Alarm Indication Signal)
Module in service
Module in standby.

External alarm signals are also available on the rear of the module.

Changeover inhibit and changeover request switches are provided on the front panel for use where modules are linked in pairs for redundancy. For this configuration a special handshake connector is provided on the rear panel to link the logic sections of two modules.

When used as a line equaliser or distribution amplifier the DDA-3100 may be housed in any of IRT’s standard Eurocard frames. When used in pairs for handshake operation only 3 RU chassis types may be used so that the two modules are as close together as possible. Details of frame types are available separately.

Applications:

- Stand alone cable equaliser or distribution amplifier.
- Paired for redundant path protection switching.

Standard features:

- Adaptive cable input equalisation.
- Data regeneration & re-clocking
- Monitor & break access facility
- Protection switching facility.
- External alarms and bypass.
- Redundancy handshake facility.
- IRT Eurocard construction compatible with other IRT Eurocard modules and frames.
- Dual power supply operation.

Equipment provided:

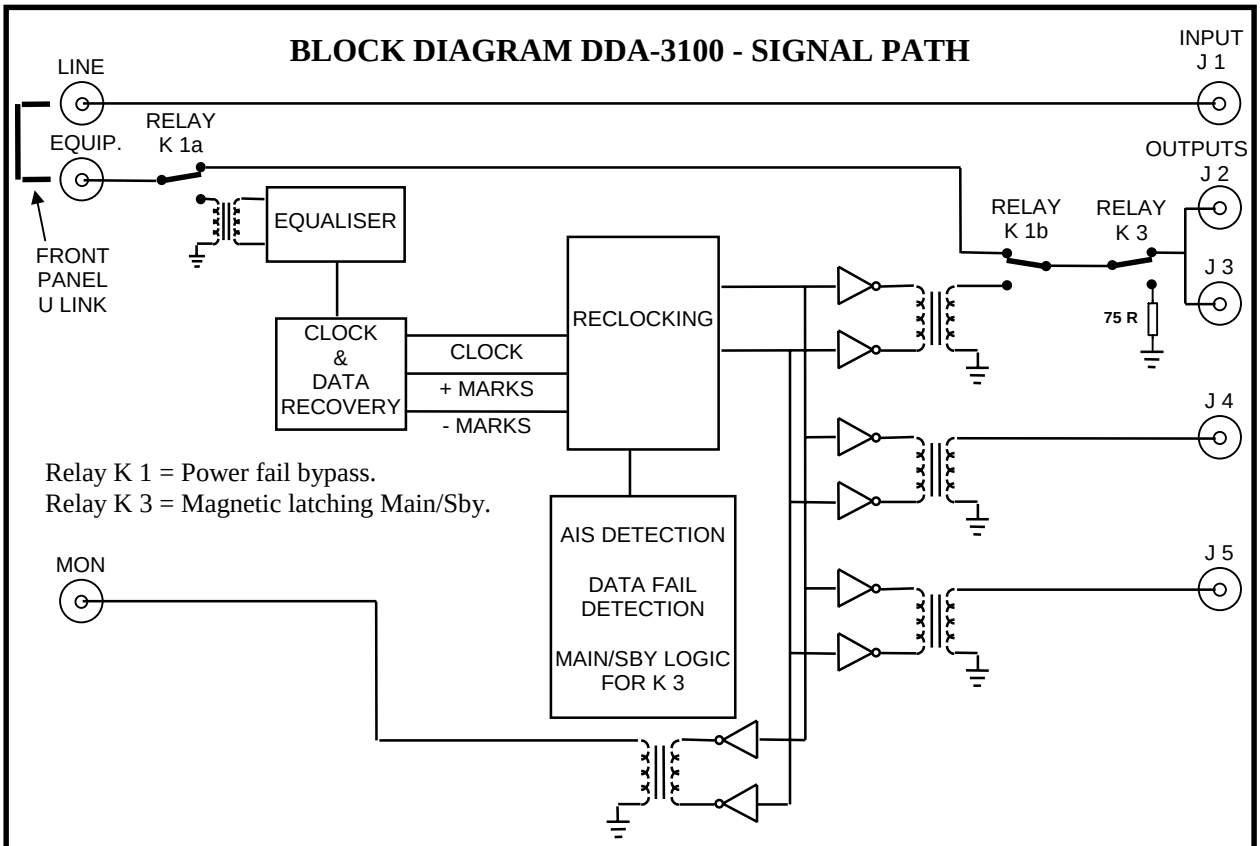
Standard: DDA-3100 34 Mb Data distribution amplifier module.
DDA-3100 Rear assembly.

Accessories available:-

GMW-3100 Data and control cable linking kit:- Provides a data link and linking control cable for connecting two adjacent DDA-3100’s for automatic changeover in the event of a fault being detected.

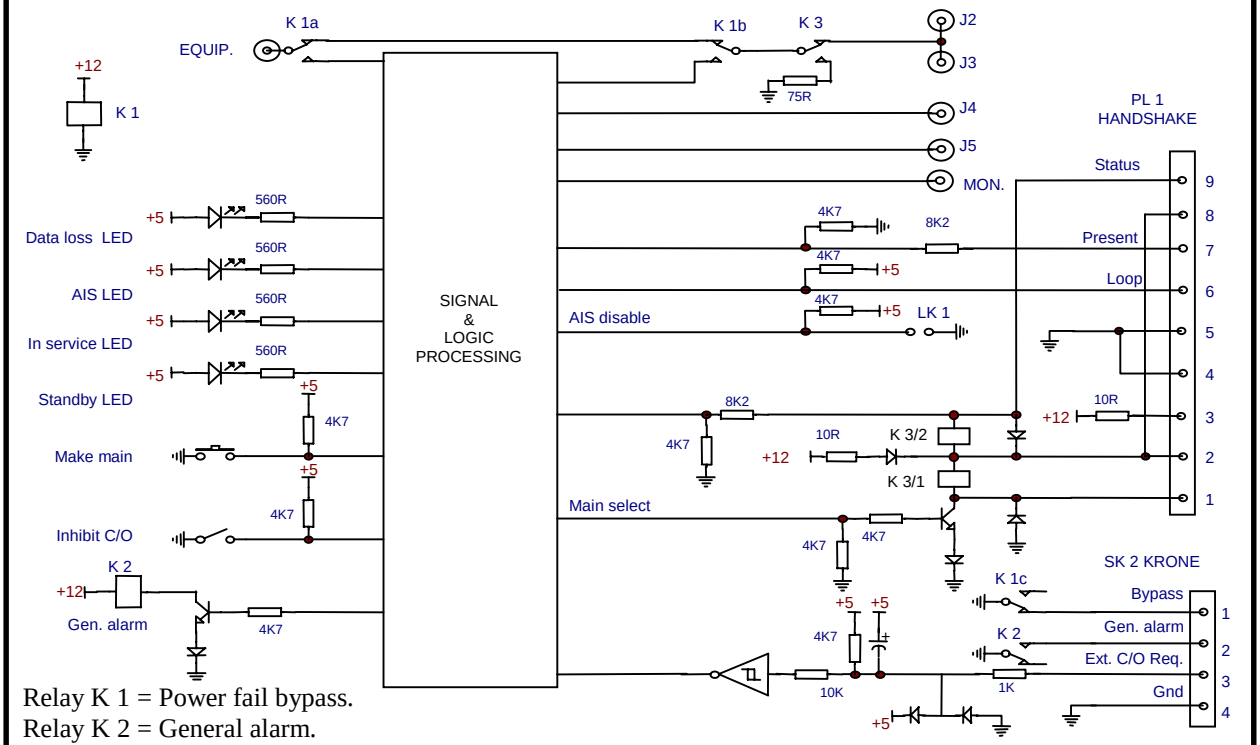
FUNCTIONAL DIAGRAMS

BLOCK DIAGRAM DDA-3100 - SIGNAL PATH



Relay K 1 = Power fail bypass.
Relay K 3 = Magnetic latching Main/Sby.

BLOCK DIAGRAM DDA-3100 - EXTERNAL LOGIC



Relay K 1 = Power fail bypass.
Relay K 2 = General alarm.
Relay K 3 = Magnetic latching Main/Sby.

TECHNICAL SPECIFICATIONS
IRT Eurocard module
Type DDA-3100

34 Mbits/s data:

Input:

Type	Transformer.
Impedance	75 Ω terminated.
Electrical Characteristics	to ITU-T Rec G.703 interface at 34,368 Kbit/s (see below).

Outputs:

Type	Transformer.
Number	3 regenerated data located on rear connection assembly. 1 output monitoring. located on front panel.
Impedance	75 Ω source terminated.
Electrical Characteristics	to ITU-T Rec G.703 interface at 34,368 Kbit/s (see below).

Performance:

Cable Equalisation	0 - 12 dB at 17,184 KHz. Components set for Beldin YR23769 cable.
Intrinsic jitter	<0.05 UI up to 800 Hz (ITU-T Rec G.751)

Controls & alarms:

Input:

External Change Over Request	A ground applied to this input will emulate the operation of the front panel switch “Change Request”.

Outputs:

Bypass	Contact closure to ground if power has failed.
General Alarm	Contact closure to ground if:- a. Data Loss is detected OR b. AIS is detected AND the AIS disable link (LK 1) is not installed. AIS detection is defined as at least 2048 consecutive data “1”s. Data Loss is defined as less than 120 data “1”s in 512 34 Mbit clock periods.

Connectors:	Data:	1.6/5.6 coaxial.
	Alarm:	Krone LSA plus.

Power Requirements:

	28 Vac CT (14-0-14) or ± 16 Vdc.
Power consumption	170 mA.

Other:

Temperature range		0 - 50° C ambient
Mechanical		Suitable for mounting in IRT 19" rack chassis types FR-748, FR-700 & FR-722 with input output and power connections on the rear panel.
Finish:	Front panel	Grey enamel, silk screened black lettering & red IRT logo.
	Rear assembly	Detachable silk screened PCB with direct mount connectors to Eurocard and external signals.
Dimensions		6 HP x 3 U x 220 mm IRT Eurocard
Standard accessories		DDA-3100 rear connector assembly.
Optional accessories		Instruction manual GMW-3100 Handshake data & control linking cable kit.

Electrical characteristics of signal:

HDB3 - to ITU-T Rec G.703

Test load impedance	75 Ohms resistive.
Nominal peak voltage of a mark (pulse)	1.0 V.
Peak voltage of a space (no pulse)	0 V ±0.1 V.
Nominal pulse width	14.55 ns
Ratio of the amplitudes of +ve & -ve pulses at the centre of a pulse interval	0.95 to 1.05
Ratio of the widths of +ve & -ve pulses at the nominal half amplitude	0.95 to 1.05
Return loss	> 16 dB 860 Hz to 1.720 KHz. > 22 dB 1.720 KHz to 34.,368 KHz. > 18 dB 34.368 KHz to 51.550 KHz

G.703 data signal format.

The following waveforms are intended to give some idea of the type of signal at various points in the DDA-3100 when in operation. They are not intended as accurate portrayals of either voltage levels or timing.

It can be seen that the original signal has both positive and negative going pulses. This format is used so that the signal does not rely on DC levels. To preserve the AC nature of the signal a coding system is used to ensure that a succession of either '1's or '0's in the original data does not produce a DC output.

The HDB3 (High Density Bi-polar of order 3) code as defined in G.703 for 34,368 Kbits/s is as follows:

Binary 1 bits are represented by alternate positive and negative pulses and binary 0 bits by spaces. Exceptions are made when strings of successive 0 bits occur in the binary signal.

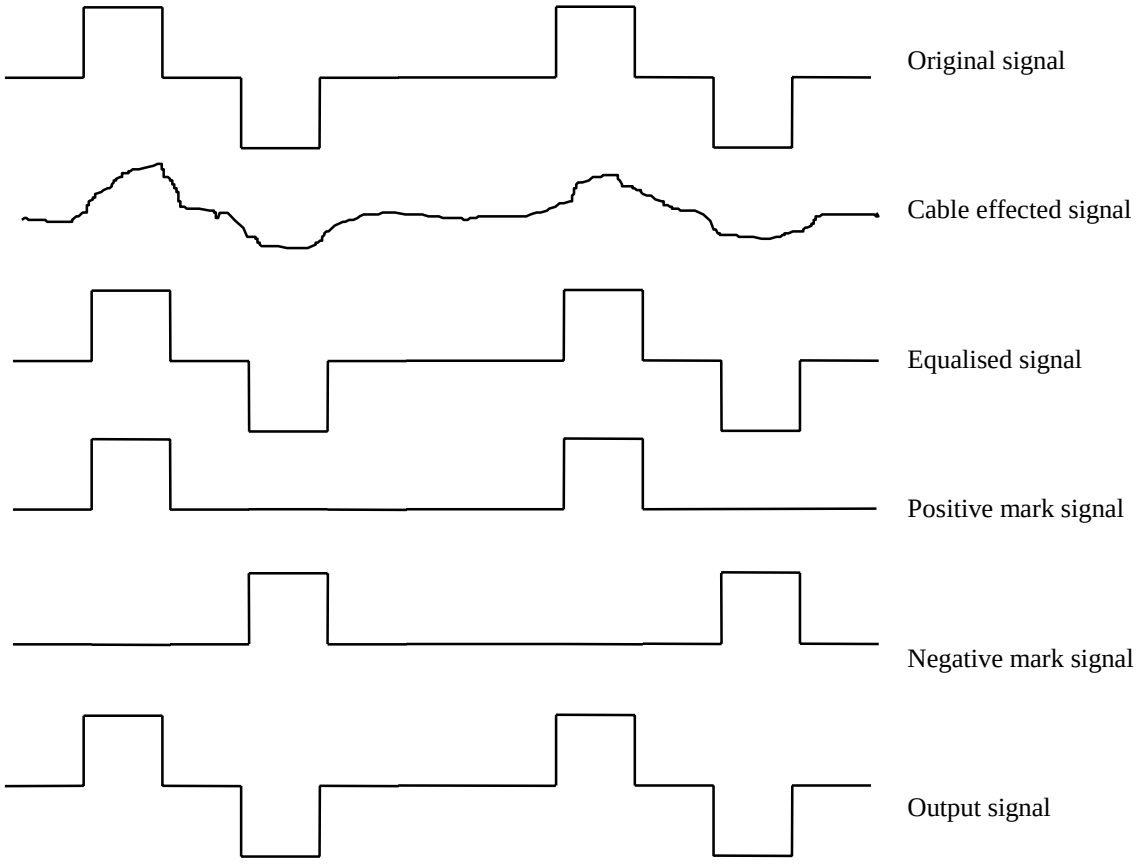
Each block of 4 successive zeros is replaced by 000V or B00V where B is an inserted pulse of the correct polarity and V is an inserted pulse violating the polarity rule. The choice of 000V or B00V is made so that the number of B pulses between consecutive V pulses is odd so that successive V pulses are of alternate polarity and so no DC component is introduced.

It can be seen that the cable effected signal bears little resemblance to the original signal and due to the high frequency attenuation looks more like a noisy analogue signal than a digital signal. The input equaliser circuit in the DDA-3100 enhances the high frequency response and detects the rate of change of the signal to produce a squared up signal with fast rise and fall times suitable for processing and re-clocking.

The signal is separated into +ve and -ve mark signals as shown. The relative timing of these signals must be closely maintained or the final re-clocked output signal will not be accurate.

The re-clocking circuit acts on each of the +ve and -ve mark signals by detecting the data rate with a phase locked loop which has a sufficiently long flywheel time to maintain the clock frequency in the presence of the maximum length '0' data signal.

The re-clocked +ve and -ve mark signals are fed to separate output drivers for each output where they are recombined in the output transformers resulting in an output signal as shown which is the same as the original signal.



DESCRIPTION OF OPERATION

See block diagrams on page 3 and drawing numbers 803285 sheets 1 to 3.

Input:

The HDB3 34 Mbits/s input signal is connected via a front panel 1.6/5.6 Series U-link to the input circuit of the amplifier. If no power is present, and the amplifier was active before the power was removed, then the signal will be directed to the output connector via K1 and K3. When power is applied the K1 relays operate and switch the signal to go via the amplifier to the K 3 relay and thence the output connectors.

The K 3 relay is of the bi-stable magnetic latching type and so will only change state when an imbalance of drive between the *set* and *reset* coils. The K 3 relay is operated under the control of the logic processor *main select* via transistor driver Q 8 to the *set* coil and released by any external signal present on the pin 9 *status* input of the handshake connector to the *reset* coil.
When power is applied to the DDA-3100 the logic circuit will cause the K 3 relay to be *set*. If two DDA-3100's are connected by the handshake kit then one of the two will take control first and become the *main* amplifier causing the other to become the *standby*. Either module can be made *main* by pressing the change request button on the front panel of the required module provided that no alarms are present. An external changeover request may also be made via pin 3 of SK 2 alarm/control connector on the rear panel provided that the changeover inhibit switch on the front panel is not in the inhibit position.
When the K 3 relay is in the *reset* position the input path from the "Equip." connector and the K 1 relay is terminated in 75 Ω to preserve the loading on the input.

Active path:

Input switching & equaliser.
The signal from the front panel "Equip." connector passes to the K 1a relay where it is connected to the input transformer and automatic line equalisation circuit consisting of transistors Q 1 to Q 6. The purpose of this equaliser is to restore both the signal level and the leading and trailing edges of the digital signal so that signal jitter is reduced prior to the clock signal being derived in the subsequent stage.

+ve & -ve mark signals and clock generator.
The equalised signal is coupled to the following stages by transformer T 2. This has two secondary windings to translate the positive and negative going components of the signal to a positive format for processing by standard single supply logic circuits in the following stages. The two signals are identified as the +ve and -ve mark signals and remain separate until the final output driver stage.

A synchronous clock signal is required by both the logic and reclocking circuits. The clock is an oscillator formed by U 3 a, b & c and is re-triggered to keep time by a signal extracted from both the +ve or -ve mark signals (OR gate U 3 d).
The clock signal is retarded by delay line DLY prior to being used in the main processing logic and reclocking circuit in order to provide the optimum timing at the reclocking point.

Logic processing, reclocking and AIS detection.
The main logic processing, reclocking, error detection and operational interfacing are all performed by logic circuits within U 4 which is a custom programmed large scale logic array. The internal logic and functions of this IC are too complex to describe in detail and the following is intended as a guide to function only.

Data loss detection.
Valid data is deemed to be present at the module input when 120 or more data pulses have been received in 512 nominal clock periods at a bit rate of 34,368 Kbits/s. In order for the data pulse to be counted, more than 60% of the minimum anticipated data pulse must be present.

If less than 120 data pulses are counted over a period of 512 clock pulses then the data signal is deemed to be invalid and the data loss flag is set.

If the area of a given pulse is less than 60% of the minimum anticipated (or acceptable) data pulse, after line equalisation and shaping, then that pulse is not considered as a valid input to the count.

In any of these cases the *Data Loss* LED on the front panel of the module will light and the general alarm relay output will be activated connecting the general alarm output contact to ground.

AIS detection.
The data processor will detect an incoming AIS (Alarm Indication Signal) (a series of >2048 1's) and will set the AIS flag and the general alarm relay output will be activated connecting the general alarm output contact to ground.

Note however that when data errors or no data is detected that the DDA-3100 does not generate an outgoing AIS data stream to the data outputs.

The AIS alarm system may be disabled by a link on the main board LK 1. This prevents the AIS detection from operating the automatic changeover function when used in handshake configuration and prevents AIS from setting the general alarm output. The AIS detection circuit will however still give an AIS indication on the front panel LED if AIS is detected.

The AIS disable link does not effect the general alarm being activated by data or signal loss as described above.

Power on reset.
A power on reset signal is generated by U 6 when power is applied to the unit. This signal causes the processing circuit to examine its current status and connections and restore operation to its state prior to power failure.

If the DDA-3100 is connected for stand-alone operation all alarms will be reset and normal operation will resume. If an AIS signal is present on the data input or data is outside the prescribed limits outlined above then the general alarm will be activated after the normal detection period has elapsed from the P.O.R. signal being initiated.

For operation in handshake mode see *Handshake* operation description.

ARA in & urgent alarm out.
These facilities are not enabled at this time.

Data signal output drivers.
The reclocked +ve and -ve mark signals are bussed to output drivers U 7 to 10.
Each output driver consists of three inverters operating in parallel in order to obtain a high current output capability for driving the output transformer without stressing any individual amplifier.

Diodes are connected across the transformer primary to ground and the inverter output to +5V to prevent any back EMF from causing damage to the drivers. The resistors between the output drivers and the output transformer set the correct output operating pulse amplitude to ±1 V measured at the output connectors.

Note that the *Mon. Output* on the front panel of the module is obtained in the same manner as the outputs on the rear of the module.

Handshake operation:

Purpose:
Handshake interconnection is required when two circuits are to be operated in 1:1 protection switching mode to provide a continuous signal output in the event of failure of the primary signal path.

Priority logic:
For this mode to be employed it is necessary to provide two programme feeds which are designated as the *Main* and *Standby* paths.
The priority switching in normal mode follows non reverting logic which dictates:

In the event of failure of main then standby DDA will assume control and become *Main* causing the failed path DDA to become *Standby*..

This implies that when the failed path is restored that it will remain as *Standby* and not become *Main* unless either a failure of *Main* occurs or a manual changeover is requested.

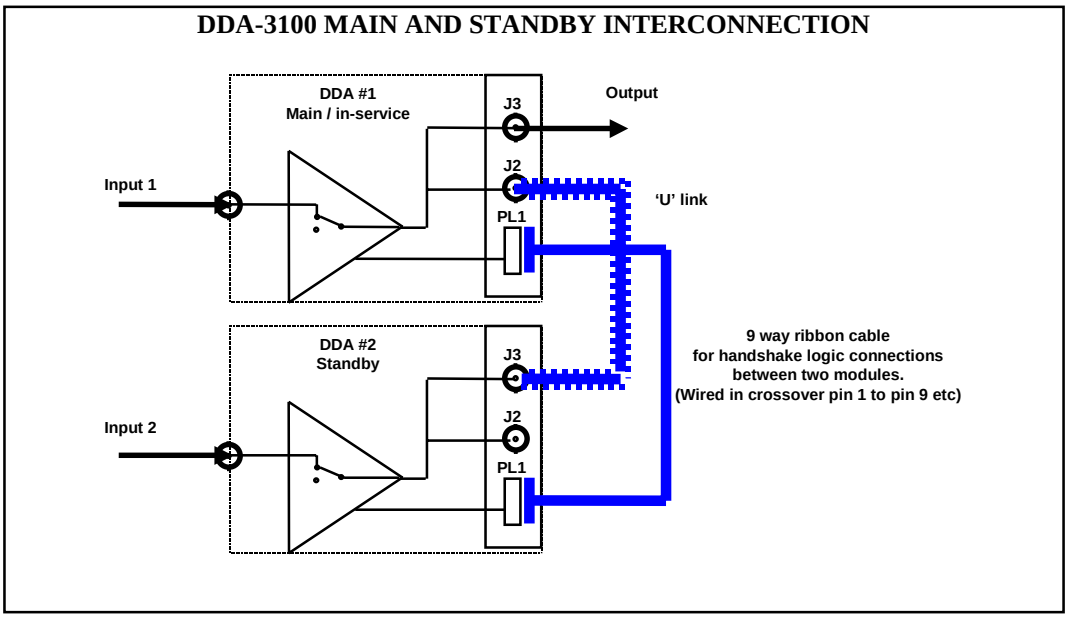
Changeover logic:
A changeover to the companion module will occur under any of the following conditions:

Loss of input signal
AIS detection alarm (provided AIS is not disabled by link LK 1)
Loss of power

In all of the above cases switching will only occur if:

the companion module is able to provide an output free of the same defects and
the changeover inhibit switch is not activated on either module.

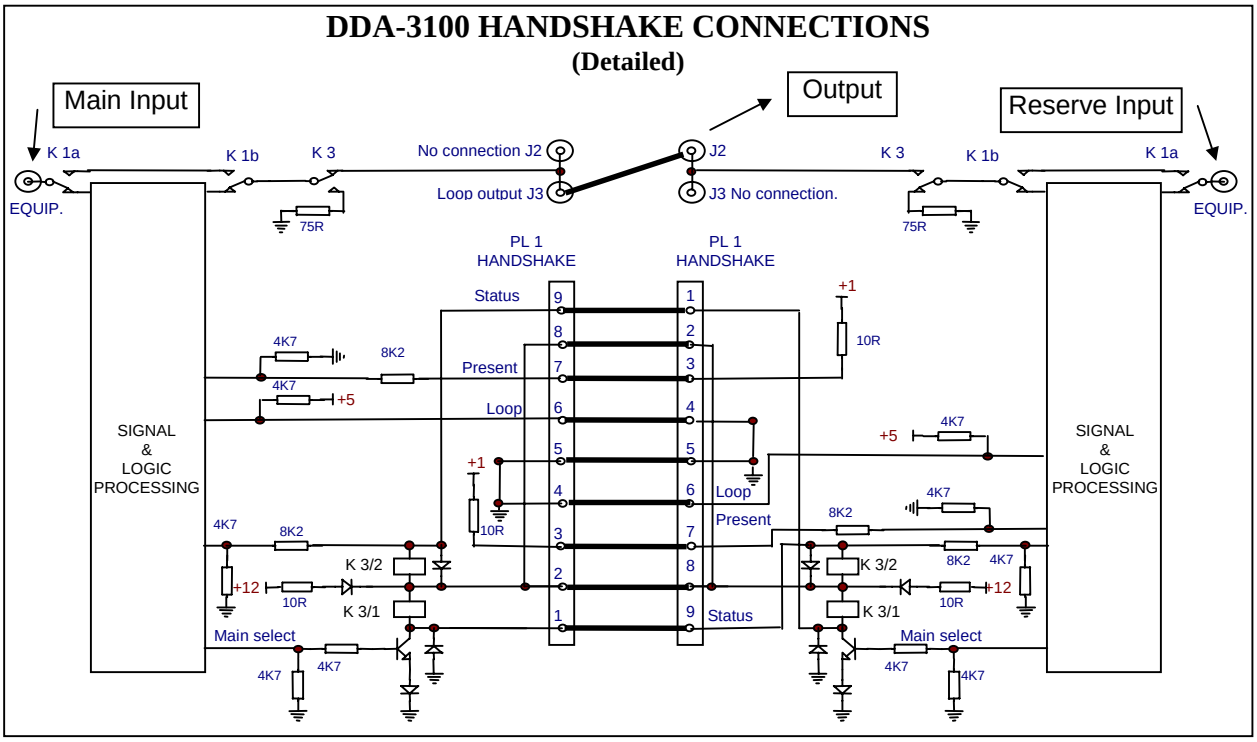
Connections:
Handshake interconnection should only be made by using the handshake kit GMW-3100 as shown on the following diagram.
This kit contains a 'U' link which provides the correct spacing and electrical characteristics required for interconnection and under no circumstances should coaxial cable be used in its place. The kit also contains a specially wired data cable which cross connects the necessary data lines for proper operation. The use of a standard data cable wired in the conventional manner of pin 1 to pin 1 etc will cause malfunction of the system.



It is important to note that in this mode only one output (J 2 / J 3) of the DDA-3100 is switched and outputs J 4 and J 5 on either DDA-3100 cannot be relied upon in this mode and should therefore normally not be used.

Detailed operational description:

Connections for handshake (paired) operation of two DDA-3100's are shown in the following diagram.



The handshake kit GMW-3100 provides the necessary connections for operating two DDA-3100's for paired operation as shown in the diagram. The kit provides both a 1.6/5.6 'U' link and a data cable to cross connect two adjacent modules in a standard 3 RU frame.

Inputs & outputs.
The two modules are supplied with signals from separate paths to their input connectors on the rear of the module. For the purposes of description these will designated as the main and reserve inputs although they may be of equal standing.

The handshake changeover is only operative on the first output of the DDA-3100 and so this is the only output provided with two connectors (J 2 & 3).
The 'U' link provided in the handshake kit connects between J 2 on one DDA-3100 and J 3 on the other. The 'U' link length and the staggered mounting of J 2 & 3 only permit the link to be connected in the correct position between adjacent modules.

Once the 'U' link is installed there is one available output connector on each module (J 2 on one and J 3 on the other). Whilst either connector may be used it is essential that ONLY ONE be connected at any time. The chosen output will provide a signal from either module when it is selected as the main.

It is important to note that the remaining outputs of each amplifier are NOT effected by the handshake arrangement and that they will therefore continue to provide an output signal derived solely from the input to that amplifier. If this signal is corrupt then so too will be these outputs just as they would be in the case of stand alone operation.

Operation.

Handshake mode detection.
Two data lines are present on the handshake connector to indicate to each module that it is to operate in handshake mode.
The *Loop* signal on pin 6 is connected to ground when another module is connected and the *Present* signal on pin 7 detects the presence of power on the alternate module.
If the *Loop* signal is not connected to ground then all handshake operations are inhibited.

If the loop signal is at ground indicating the presence of an alternate module and if power is present on both modules then normal handshake operation is permitted. If the *Present* signal indicates that power is lost on the alternate module then the module with power will take control and become *Main*.

Power on reset.
When power is applied to the pair the *power on reset* signal will attempt to reset both modules. However, as only one module can be *Main*, the logic processor checks for handshake operation and if detected then the module which was last enabled as *Main* will take control as *Main* and the other module will be forced to act as *Reserve*.
This memory capability is due to the latching nature of the K 3 relay which will cause the *Main* and *Reserve* paths to be maintained even in the absence of power.

The only exception to this rule is when power is applied to a pair for the first time that they are coupled in handshake mode. In this special case both modules will initially have their K 3 relays in the active path condition and so both will attempt to become *Main*. As the P.O.R. signal for each module will be slightly different for any two modules, one will reach its operating mode first and will force the other module to immediately change to become *Reserve.*
As the selection of which module becomes *Main* is cannot be determined before installation it may be necessary to force the desired module to become main by pressing the *Change Request* button on the front panel of the desired module. The *Main* module will be indicated by the *In Service* LED being lit on the front panel.

Automatic changeover.
An automatic changeover is initiated whenever the power fails on *Main* and not on *Reserve* or when a general alarm is initiated on *Main* (indicating either loss of input signal or AIS indication if the AIS is enabled) and the *Change Inhibit* switch is not active on either module.
In either case the *Main Status* line will go from LO to HI and the companion module on detecting this change will then switch its *Main Select* line to HI causing the K 3/1 relay driver to activate the relay (hence becoming *Main*) and send the *Status* line to the first module LO confirming the change and preventing that module from attempting to become *Main* again.

Manual changeover.
A manual changeover is initiated by pressing the *Change Request* button on the front of the module which is required to become *Main*. The mechanism of the change is similar to the automatic changeover described above except that it is initiated by the module requesting that it become *Main*. This forces the *Status* line to the other module to LO and it immediately responds to become *Reserve*.

PRE-INSTALLATION

Handling:

The modules used in this equipment contain static sensitive devices and proper static free handling precautions should be observed.

Where individual circuit cards are stored, they should be placed in antistatic bags and proper antistatic procedures should be followed when inserting or removing cards from these bags.

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Where individual circuit cards are stored, they should be placed in antistatic bags and proper antistatic procedures should be followed when inserting or removing cards from these bags.

Power:

AC mains supply: Ensure that operating voltage of unit and local supply voltage match and that correct rating fuse is installed for local supply.

DC supply: Ensure that correct polarity is observed and that DC supply voltage is maintained within the operating range specified.

Earthing:

AC mains supply: Chassis earth connection of the equipment is via the earth connection on the three pin mains input. This is a safety earth and must be connected.

DC supply: Chassis earth connection of the equipment is via the positive terminal on the DC input. The DC positive supply should be connected to earth at the supply . A separate chassis earth connection is available on the centre connector of the DC input connector which may be connected if desired.

Signal earth: The power supply wiring on each Eurocard has a common reference earth connected to the reference earth of the main frame power supply. For AC mains supply this is the centretap of the stepdown transformers and for DC supply it is the common output of the +ve & -ve DC-DC converters. In both cases there is no direct connection between this earth and chassis earth.
For safety reasons a connection should be made between signal earth and chassis earth at some point in the system. For best performance of the system some experimentation may be required in determining the best placement of this connection. In order to avoid earth loops, resulting in the introduction of hum, only one connection should be made between the signal and chassis earths.

Inputs:	Internally connected to PSU reference earth.
Outputs:	Internally connected to PSU reference earth.

OPERATIONAL SAFETY

WARNING

Operation of electronic equipment involves the use of voltages and currents which may be dangerous to human life. Maintenance personnel should observe all safety regulations. Do not change components or make adjustments inside the equipment with power **ON** unless proper precautions are observed. Note that under certain conditions dangerous potentials may exist in some circuits even though power controls are in the **OFF** position.

INTERNAL ADJUSTMENTS

The only internal adjustment that may be made by the user is link LK 1 which may be set to disable AIS detection if required.

This module uses a programmable logic device as the main processing circuit. This device must be correctly programmed is only obtainable through IRT. No attempt should be made to substitute other devices or to programme a similar device as this could cause extensive damage to the module.

INSTALLATION

Installation in frame or chassis:

See details in separate manual for selected frame type.

34 Mb data connections - stand alone operation:

Connect the input and as many output connections as required. Note that the first output is provided with two connectors J2 & J 3. These are provided for connection in handshake mode and ONLY ONE must be used to connect to an external mode.

34 Mb data connections - handshake operation:

See separate section on handshake operation.

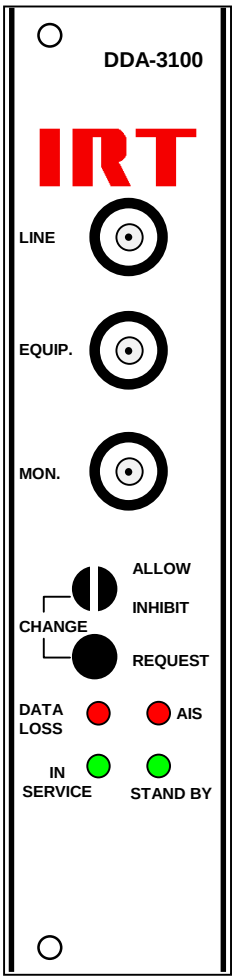
Alarm and external changeover connections:

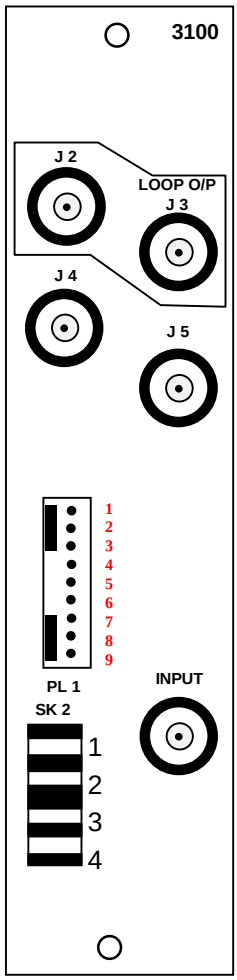
A Krone type connector is provided on the rear panel of the module providing the following:

Pin	1	K 1 relay status - connection to ground indicates module is in bypass mode.
	2	K 2 relay status - connection to ground indicates module is *Main* in handshake mode.
	3	External changeover request - connection to ground will make this module *Main* in handshake mode.
	4	Ground.

Front & rear panel diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show relative positions of connectors, indicators and controls only.





MAINTENANCE & STORAGE

Maintenance:

No regular maintenance is required.

Care however should be taken to ensure that all connectors are kept clean and free from contamination of any kind. This is especially important with optical connections where cleanliness is critical.

Storage:

If the equipment is not to be used for an extended period it is recommended the whole unit be placed in a sealed plastic bag to prevent dust contamination. In areas of high humidity a suitably sized bag of silica gel should be included to assist deter corrosion.

Where individual circuit cards are stored, they should be placed in antistatic bags and proper antistatic procedures should be followed when inserting or removing cards from these bags.

Warranty & Service

Equipment is covered by a limited warranty period of five years from date of first delivery unless contrary conditions apply under a particular contract of supply.

Equipment warranty is limited to faults attributable to defects in original design or manufacture. Warranty on components shall be extended by IRT only to the extent obtainable from the component supplier.

Equipment return:

Prior to arranging service ensure that the fault is in the unit to be serviced and not in associated equipment. If possible confirm this by substitution.

Before returning equipment contact should be made with IRT or your local agent to determine whether the equipment can be serviced in the field or should be returned for repair.

The equipment should be properly packed for return observing antistatic procedures.

The following information should accompany the unit to be returned:

1. A fault report should be included indicating the nature of the fault
2. The operating conditions under which the fault initially occurred.
3. Any additional information which may be of assistance in fault location and remedy.
4. A contact name and phone and fax numbers.
5. Details of payment method for items not covered by warranty.
6. Full return address.

Please note that all freight charges are the responsibility of the customer.

The equipment should be returned **to the agent who originally supplied the equipment or, where this is not possible**, to IRT direct as follows.

Equipment Service
IRT Electronics Pty Ltd
26 Hotham Parade
ARTARMON
N.S.W. 2064
AUSTRALIA

Phone: 61 2 9439 3744
Fax: 61 2 9439 7439

DRAWING LIST INDEX

Drawing #	Sheet #	Description
803825	1	DDA-3100 schematic diagram part 1.
803825	2	DDA-3100 schematic diagram part 2.
803825	3	DDA-3100 handshake cable connections.